
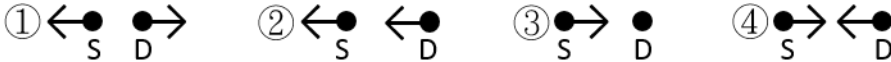


# 111 學年度學士後醫學系招生考試

## 物理 試題

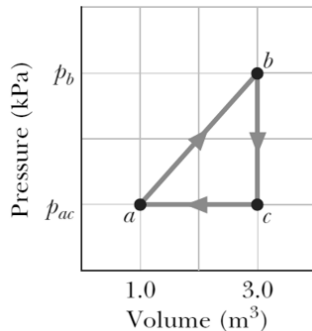
Choose one best answer for the following questions

【單選題】每題 1 分，共計 30 分，答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。1~15 題為物理，16~30 題為化學。

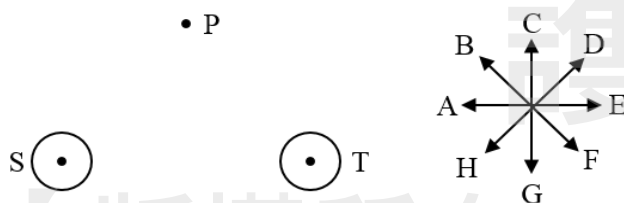
- $1.25 \times 0.25 + 1.222 = \underline{\hspace{2cm}}$ .  
 (A) 1.5345      (B) 1.535      (C) 1.53      (D) 1.5      (E) 2
- Over a short interval near time  $t = 0$  the coordinate of a bicycle in meters is given by  $x(t) = 12t - 4t^3$ , where  $t$  is in seconds. At the end of 1 s, what is the acceleration of the bicycle?  
 (A)  $23 \text{ m/s}^2$       (B)  $15 \text{ m/s}^2$       (C)  $-4 \text{ m/s}^2$       (D)  $-12 \text{ m/s}^2$       (E)  $-24 \text{ m/s}^2$
- A 8000-N trunk is pushed along a level road by two men who apply a total forward force of 1000 N. Neglecting friction, what is the acceleration of the trunk?  
 (Gravitational acceleration  $g = 10 \text{ m/s}^2$ )  
 (A)  $0.0125 \text{ m/s}^2$       (B)  $0.125 \text{ m/s}^2$       (C)  $0.8 \text{ m/s}^2$   
 (D)  $1.25 \text{ m/s}^2$       (E)  $8 \text{ m/s}^2$
- An incompressible fluid of density  $\rho$  is in a bucket on the elevator floor accelerating upward with acceleration  $a$ . What is the pressure difference between two points in the fluid separated by a vertical distance  $\Delta h$ ? (Gravitational acceleration is  $g$ )  
 (A)  $\rho a \Delta h$       (B)  $\rho g \Delta h$       (C)  $\rho g a \Delta h$       (D)  $\rho(g - a) \Delta h$       (E)  $\rho(g + a) \Delta h$
- The figure shows a standing wave pattern in a string. What is the wavelength of one of the component traveling waves?  
  
 (A) 10 cm      (B) 20 cm      (C) 40 cm      (D) 60 cm      (E) 120 cm
- The figure shows four situations in which a source of sound S and a detector D are either moving or stationary. The arrows indicate the directions of motion. The speeds (when not zero) are all the same. (Note that the detector in situation ③ is stationary). Rank the situations according to the apparent frequency of the source, lowest to highest.  
  
 (A) ①,②,③,④      (B) ④,③,②,①      (C) ①,③,②,④  
 (D) ②,①,④,③      (E) ②,①,③,④
- What is the deterministic factor of a sound wave for the sound pitch?  
 (A) amplitude      (B) frequency      (C) phase      (D) speed      (E) intensity

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8. A sample of an ideal gas is taken through the cyclic process  $abca$  shown in the figure. The scale of the vertical axis is set by  $p_b = 15$  kPa and  $p_{ac} = 5$  kPa. At point  $a$ ,  $T = 200$  K. What is the temperature of the gas at point  $c$ ?



- (A) 400 K      (B) 600 K      (C) 1419 K      (D) 1800 K      (E) 4258 K
9. An engine does 15 kJ of work while exhausting 37 kJ to a cold reservoir. What is the efficiency of the engine?
- (A) 28.8 %      (B) 38.8 %      (C) 68.8 %      (D) 88.8 %      (E) 98.8 %
10. The point P lies along the perpendicular bisector of the line connecting two long straight wires S and T that are perpendicular to the page. A set of directions A through H is shown next to the figure. When the two equal currents in the wires are directed up out of the page, the direction of the magnetic field at P is closest to the direction of \_\_\_\_\_.



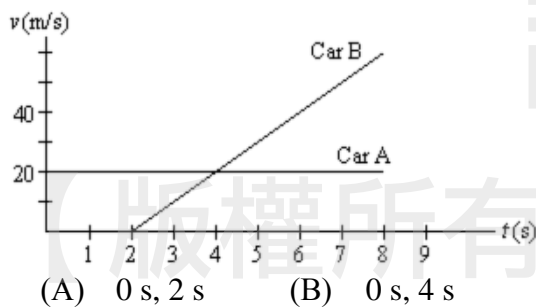
- (A) A      (B) E      (C) F      (D) G      (E) H
11. Consider radio waves (r), visible light (v), infrared (i), X-rays (x), and ultraviolet (u). In order of increasing frequency, they are \_\_\_\_\_.
- (A) r, v, i, x, u      (B) r, i, v, u, x      (C) i, r, v, u, x      (D) x, u, v, i, r      (E) r, i, v, x, u
12. An erect object is in front of a convex mirror a distance greater than the focal length. The image is \_\_\_\_\_.
- (A) real, inverted, and smaller than the object  
 (B) virtual, inverted, and larger than the object  
 (C) real, inverted, and larger than the object  
 (D) virtual, erect, and smaller than the object  
 (E) real, erect, and larger than the object

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13. The major physics principle that supports endoscope is \_\_\_\_\_.
- (A) refraction of light                      (B) diffraction of light  
(C) interference of light                    (D) scattering of light  
(E) total internal reflection of light
14. If we increase the wavelength of the light that falls on the metal in a photoelectric-effect experiment, which of the following will happen?
- (A) The work function of the metal increases.  
(B) The cutoff frequency decreases.  
(C) The stopping potential decreases.  
(D) The time delay of the emission of photoelectron increases.  
(E) All of the above.
15. For the particles listed below with the same kinetic energy, which has the shortest wavelength?
- (A) electron    (B) positron    (C) proton    (D)  $\alpha$  particle    (E) neutron

**【單選題】** 每題 2 分，共計 120 分，答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。31~60 題為物理，61~90 題為化學。

31. The velocities of drivers A and B are shown as functions of time in the figure below. Driver B starts her car at the instant driver A passes her. At which moment on the graph are drivers A and B side by side?



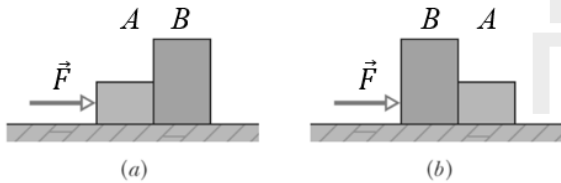
32. A uniform cord has the mass per unit length  $\lambda$  and it is arranged as that shown in the figure. Here the tension is maintained by suspending an object of mass  $M$  from one end. What is the speed of a pulse on the cord if the tension force is not affected by the mass of the cord? (Gravitational acceleration is  $g$ )



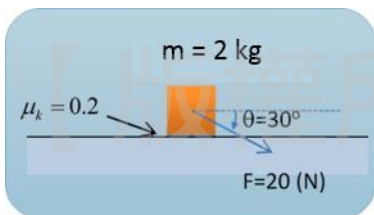
- (A)  $v = \sqrt{\frac{Mg}{2\lambda}}$     (B)  $v = \sqrt{\frac{Mg}{\lambda}}$     (C)  $v = 3\sqrt{\frac{Mg}{\lambda}}$   
(D)  $v = 2\sqrt{\frac{Mg}{\lambda}}$     (E)  $v = \pi\sqrt{\frac{Mg}{\lambda}}$

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33. As shown in figures (a) and (b), a constant force  $F$  is applied to the two contact blocks in both cases. In figure (a), block A pushes against block B with a 20 N force directed horizontally to the right. In figure (b), block A pushes against block B with a 10 N force directed horizontally to the left. The total mass of two blocks is 12 kg. Which of the following statement is *correct*? (Gravitational acceleration  $g = 10 \text{ m/s}^2$ )



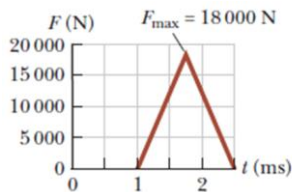
- (A) The magnitude of  $F$  is 20 N.  
 (B) The mass ratio between block A and B is 2.  
 (C) The acceleration in (a) is  $1.5 \text{ m/s}^2$ .  
 (D) The acceleration in (b) is  $2.5 \text{ m/s}^2$ .  
 (E) The mass of block A is 8 kg.
34. A force of  $\vec{F} = 3x^2\hat{i} + 4y\hat{j}$  acts on a particle, changing only the kinetic energy of the particle. How much work is done on the particle as it moves from (2, 3) to (3, 0)?  
 (A) 6                      (B) 5                      (C) 3                      (D) 2                      (E) 1
35. A block of mass 2 kg on a table is pushed by a force of 20 N directed with an angle of  $30^\circ$  downward from the horizontal as shown in the figure. The kinetic frictional coefficient is 0.2. What is the work done by the frictional force after traveling 10 m long? (Gravitational acceleration  $g = 10 \text{ m/s}^2$ )



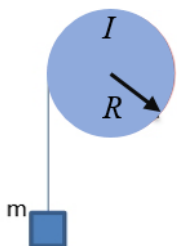
- (A) 10 J                      (B) 30 J                      (C) 40 J                      (D) 50 J                      (E) 60 J
36. A bullet is hitting and getting stuck in a wood cube, which is sitting on a frictionless table. For this bullet-wood system, which item is not conserved before and after the collision event?  
 (A) total kinetic energy                      (B) total linear momentum  
 (C) total angular momentum                      (D) total mass  
 (E) None of the above.

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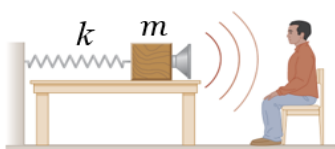
37. An estimated force-time curve for a baseball struck by a bat is shown in the figure. From this curve, determine the average force exerted on the ball.



- (A) 3 kN      (B) 5 kN      (C) 6 kN      (D) 7 kN      (E) 9 kN
38. A ball of mass  $m$  is released from a height of  $H$ . What is its speed when it is at a height of  $y$ ? (Gravitational acceleration is  $g$ )
- (A)  $\sqrt{gH}$       (B)  $2\sqrt{gy}$       (C)  $\sqrt{2g(H-y)}$       (D)  $\sqrt{g(H-y)}$       (E)  $\sqrt{2gy}$
39. A wheel of radius  $R$  and moment of inertia  $I$  is mounted on a frictionless horizontal axle as shown in the figure. A light cord wrapped around the wheel supports an object of mass  $m$ . What is the linear acceleration of the object? (Gravitational acceleration is  $g$ )



- (A)  $a = \frac{mg}{m + I/R^2}$       (B)  $a = \frac{mg}{m + I/2R^2}$       (C)  $a = \frac{mg}{m + 2I/R^2}$
- (D)  $a = \frac{mg}{2m + I/R^2}$       (E)  $a = \frac{2mg}{3(m + I/R^2)}$
40. A block with a speaker bolted to it is connected to a spring having spring constant  $k = 20 \text{ N/m}$  as shown in figure. The total mass of the block and speaker is 5 kg, and the amplitude of this unit's motion is 0.5 m. The speaker emits sound waves of frequency 440 Hz. Determine the highest frequency heard by the person to the right of the speaker. (Assume that the speed of sound is 343 m/s)



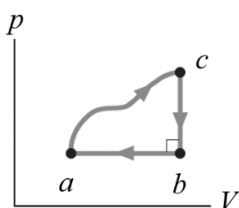
- (A) 481 Hz      (B) 471 Hz      (C) 461 Hz      (D) 451 Hz      (E) 441 Hz

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41. A wire of length  $L$ , Young's modulus  $Y$ , and cross-sectional area  $A$  is stretched elastically by an amount  $\Delta L$ . It behaves as a spring by using the Hooke's law. What is the work done in stretching the wire by an amount  $\Delta L$ ?
- (A)  $\frac{YA}{L^2}(\Delta L)^2$  (B)  $\frac{1}{2}\frac{YA}{L^2}(\Delta L)^2$  (C)  $\frac{1}{2}\frac{Y}{L^2}(\Delta L)^2$  (D)  $\frac{1}{2}\frac{YA}{L}(\Delta L)^2$  (E)  $\frac{YA}{L}\Delta L$
42. A balloon filled with air is pulled into a tank of water at room temperature. As the balloon sinks, the air pressure inside the balloon \_\_\_\_\_.
- (A) increases (B) remains the same (C) decreases  
(D) increases then decreases (E) decreases then increases
43. Ethanol of density  $\rho_E$  flows smoothly through a horizontal pipe that tapers in cross-sectional area from  $A_1$  to  $A_2$  ( $A_1 = 2A_2$ ) as shown in the figure. The pressure difference between the wide and narrow sections of pipe is  $\Delta P$ . What is the volume flow rate of the ethanol?



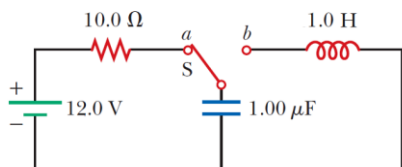
- (A)  $A_1 \sqrt{\frac{2\Delta P}{3\rho_E}}$  (B)  $A_1 \sqrt{\frac{\Delta P}{\rho_E}}$  (C)  $A_1 \sqrt{\frac{\Delta P}{3\rho_E}}$  (D)  $A_1 \frac{\Delta P}{\rho_E}$  (E)  $A_1 \frac{\Delta P}{3\rho_E}$
44. An ideal monoatomic gas of one mole is at pressure  $P$ , volume  $V$ , and temperature  $T$ . The gas is heated at constant volume to  $2T$ . Then the gas is allowed to expand at constant temperature to  $2V$ . Finally, the gas cools at constant pressure to  $T$ . What is the net entropy change for this ideal gas? (The ideal gas constant is  $R$ )
- (A)  $R \ln 2$  (B)  $-R \ln 2$  (C)  $0$  (D)  $R \ln 4$   
(E) not calculatable by the above information
45. The figure shows a closed cycle for a gas. From  $c$  to  $b$ ,  $60 \text{ J}$  is transferred from the gas as heat. From  $b$  to  $a$ ,  $100 \text{ J}$  is transferred from the gas as heat, and the magnitude of the work done by the gas is  $80 \text{ J}$ . From  $a$  to  $c$ ,  $400 \text{ J}$  is transferred to the gas as heat. What is the work done by the gas from  $a$  to  $c$ ?



- (A)  $-240 \text{ J}$  (B)  $240 \text{ J}$  (C)  $320 \text{ J}$  (D)  $-320 \text{ J}$  (E)  $-160 \text{ J}$

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46. A quantity of an ideal gas is compressed to half its initial volume. The process may be adiabatic, isothermal or occurring at isobaric. Rank those three processes in order of the work required of an external agent, least to greatest.
- (A) adiabatic, isothermal, isobaric                      (B) adiabatic, isobaric, isothermal  
(C) isothermal, adiabatic, isobaric                      (D) isobaric, adiabatic, isothermal  
(E) isobaric, isothermal, adiabatic
47. An ideal parallel-plate capacitor connected to a battery of voltage  $V_0$ , it has charge of magnitude  $Q_0$  on its plates. The plates are pulled apart to a separation from  $d$  to  $2d$  while the capacitor remains connected to the battery. After the plates are  $2d$  apart, what are the magnitude of the charge on the plates and the potential difference between them?
- (A)  $0.5Q_0, 0.5V_0$                       (B)  $0.5Q_0, V_0$                       (C)  $Q_0, V_0$   
(D)  $2Q_0, V_0$                       (E)  $2Q_0, 2V_0$
48. A group of identical capacitors is connected first in series and then in parallel. The combined capacitance in parallel is 100 times larger than for the series connection. How many capacitors are in the group?
- (A) 5                      (B) 10                      (C) 50                      (D) 100                      (E) 200
49. A cylinder contains  $n$  mol of helium gas (ideal monatomic gas) at a temperature of 300 K. The universal gas constant is  $R$  ( $R = N_A k_B$ ), where  $N_A$  is Avogadro's number and  $k_B$  is Boltzmann's constant. If the gas is heated at constant pressure, how much energy must be transferred by heat to the gas after it is heated to 500 K?
- (A)  $200nR$                       (B)  $300nR$                       (C)  $500nR$                       (D)  $800nR$                       (E)  $1000nR$
50. The switch is connected to position  $a$  for a long time interval as shown in the figure. At  $t = 0$ , the switch is thrown to position  $b$ . After this time, what are the frequency of oscillation of the LC circuit?



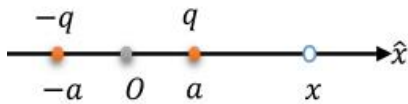
- (A) 159 Hz                      (B) 359 Hz                      (C) 559 Hz                      (D) 759 Hz                      (E) 959 Hz

51. An infinite long wire is charged uniformly with line charge density  $\lambda$ . What is the electric field at a point with a distance  $y$  from the wire? (Electric constant is  $\epsilon_0$ )

- (A)  $\frac{\lambda}{\epsilon_0 y}$                       (B)  $\frac{\lambda}{\pi \epsilon_0 y}$                       (C)  $\frac{\lambda}{2\pi \epsilon_0 y}$                       (D)  $\frac{\lambda}{\epsilon_0}$                       (E)  $\frac{2\lambda}{\epsilon_0}$

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52. A charge  $+q$  is at the position  $a$  and a second charge  $-q$  is placed at  $-a$  as shown in the figure. What is the limiting form of the electric field for  $x \gg a$ ? (Coulomb's constant is  $k_e$ )



- (A)  $\frac{k_e qa}{x^2}$       (B)  $\frac{4k_e qa}{x^2}$       (C)  $\frac{k_e qa}{x^3}$       (D)  $\frac{4k_e qa}{x^3}$       (E)  $\frac{2k_e qa}{x^3}$

53. A 30-turn circular coil of radius 1 m and resistance  $1 \Omega$  is placed in a magnetic field directed perpendicular to the plane of the coil. The magnitude of the magnetic field varies in time according to the expression  $B = 0.1 t + 0.04 t^2$ , where  $B$  is in tesla and  $t$  is in second. Calculate the induced emf in the coil at  $t = 5$  s.

- (A) 27 V      (B) 37 V      (C) 47 V      (D) 57 V      (E) 67 V

54. Electric currents  $I_1$  and  $I_2$  are flowing through two parallel electric wires which are separated apart by a distance  $R$ . What is the force per unit length between the two parallel wires?

(Magnetic constant is  $\mu_0$ )

- (A)  $\frac{\mu_0 I_1}{2\pi R}$       (B)  $\frac{\mu_0 I_2}{\pi R}$       (C)  $\frac{\mu_0 I_1 I_2}{2\pi R}$       (D)  $\frac{\mu_0 I_1 I_2}{\pi R}$       (E)  $\frac{2\mu_0 I_1 I_2}{\pi R}$

55. While you are under water in a pool, you look up and see objects above water in a circle of light with a radius  $R$ . The rest of your vision is the color of the sides of the pool. Assume that the index of refraction of air is 1 and that of water is  $n$ . How deep are you in the pool?

- (A)  $R\sqrt{n-1}$       (B)  $\frac{R}{n}$       (C)  $\frac{R}{\sqrt{n^2-1}}$       (D)  $Rn$       (E)  $R\sqrt{n^2-1}$

56. The pupil of a cat's eye narrows to a vertical slit of width 0.5 mm in daylight. Assume the average wavelength of the light is 500 nm. What is the angular resolution for horizontally separated mice?

- (A)  $1.0 \times 10^{-3}$  rad      (B)  $2.0 \times 10^{-3}$  rad      (C)  $2.5 \times 10^{-3}$  rad  
(D)  $3.0 \times 10^{-3}$  rad      (E)  $3.5 \times 10^{-3}$  rad

57. The focal length of a spherical, concave mirror is 8 cm. An object is placed at a distance of 24 cm in front of the mirror. How fast does the image move if the object starts to move at speed  $v_p$  toward the concave mirror?

- (A)  $v_p$       (B)  $0.50 v_p$       (C)  $0.25 v_p$       (D)  $0.20 v_p$       (E)  $0.18 v_p$



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58. In a lecture demonstration of single-slit diffraction, a laser beam of wavelength  $\lambda$  passes through a vertical slit of a wide  $a$  and hits a screen at a distance of  $L$  away. What is the width of the central diffraction maximum on the screen?
- (A)  $L\frac{\lambda}{a}$       (B)  $2L\frac{\lambda}{a}$       (C)  $4L\frac{\lambda}{a}$       (D)  $3L\frac{a}{\lambda}$       (E)  $L\frac{a}{\lambda}$
59. An AC voltage source is connected to a capacitor. There is a phase difference between the voltage across the capacitor and the current passing it. Which of the following statement is *correct*?
- (A) The phase of the current leads the voltage by  $\pi/2$ .  
 (B) The phase of the current leads the voltage by  $\pi/4$ .  
 (C) The phase of the current lags the voltage by  $\pi/2$ .  
 (D) The phase of the current lags the voltage by  $\pi/4$ .  
 (E) None of the above.
60. MRI machine probes the concentration distribution of water molecules by detecting the magnetic resonance between the nucleus of hydrogen atoms, placed in a strong static magnetic field  $B$ , and a small alternating magnetic field of frequency  $f$ . If  $B$  is 2T and the z-component of the proton magnetic moment is  $1.4 \times 10^{-26}$  J/T. What is the frequency  $f$  of the alternating magnetic field? (Plank constant is  $6.6 \times 10^{-34}$  J/s)
- (A) 43 MHz      (B) 85 MHz      (C) 170 MHz      (D) 340 MHz      (E) 680 MHz

後醫-物理及化學

題號	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
答案	C	E	D	E	C	A	B	B	A	A	B	D	E	C	D	B	B	C	A	D
題號	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
答案	A	D	C	D	E	E	A	A	D	E	D	B	D	E	E	A	E	C	A	E
題號	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
答案	D	A	A	C	C	E	B	B	C	A	C	D	C	C	E	A	C	B	A	B
題號	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
答案	A	B	E	A	B	E	A	E	D	C	D	D	C	C	D	E	B	C	D	C
題號	81	82	83	84	85	86	87	88	89	90										
答案	A	B	B	D	B	B	A	C	C	A										

高雄醫學大學 111 學年度學士後醫學系招生考試試題參考答案疑義釋疑公告

科目	題號	釋疑答覆	釋疑結果
物理	35	摩擦力做負功，本題應為-60 J。	無正確答案 (送分)

# 物 理

程量子(陳宗德)老師提供

## 考情分析

以下針對111年學士後西醫物理考科之分析：

1. 在難易度方面，相較於過去幾年物理考卷，今年的試題出題較為嚴謹，題目不難，簡單易懂，沒有模糊且讓人混淆的題目。本次試題乍看之下，可能會覺得很難，但是仔細看過後，非常簡單，若物理觀念了解，只要簡單計算即可。大部分95%以上的題目，於先修、正課、特訓班課堂中、作業練習中及七百題題庫皆教授過，且做過多次練習，只是題目換句話說，若物理觀念不錯，可直接作答。
2. 在考題命中率方面，此次試卷內容與上課教材、平時作業、複習卷、七百題題庫、總複習課程題庫、實戰解析課程之題庫及高點建國所提供的模擬考有90%以上的命中率，若將來同學們平時訓練足夠，提升運算速度，則分數可以提升許多，並可增加上榜的機率。
3. 在命題範圍方面，相較於過去幾年物理考卷而言，今年物理試題，考題較為新穎，有內視鏡的原理、MRI的能階計算等，將來列入上課內容。此次試題，可以感覺到出題老師的用心，物理觀念清楚，即可作答。
4. 猜測預估物理考科平均分數，滿分75分，70分以上則算不錯，平均應會落在65分上下。

程量子筆

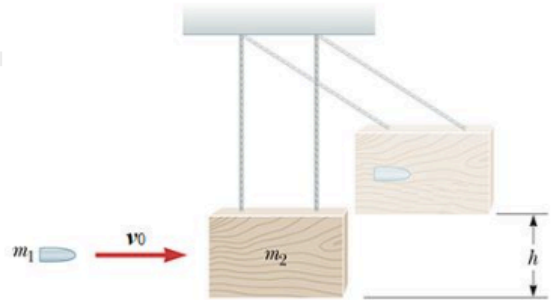
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## 命中事實

## 高醫後西醫物理110年第六題

100% 命中

6. The ballistic pendulum has mass 10 kg. A bullet of 300 g moves at the speed of  $v_0$  right before hitting the pendulum. How much is the height  $h$  that the pendulum can swing upward and rest momentarily? (Gravitational acceleration  $g = 10 \text{ m/s}^2$ )



- (A)  $6.7 \times 10^{-5} v_0^2$       (B)  $4.2 \times 10^{-5} v_0^2$       (C)  $3.3 \times 10^{-5} v_0^2$   
 (D)  $2.3 \times 10^{-5} v_0^2$       (E)  $5.7 \times 10^{-5} v_0^2$

## 高點程量子物理 (上課講義) 第五章第二十題

解

碰撞前後那一剎那，系統在水平方向未受外力，故水平方向之動量守恆

$$\Rightarrow mv + 0 = (m + M)V_{cm} \Rightarrow V_{cm} = \frac{m}{m + M}v \text{-----(1)}$$

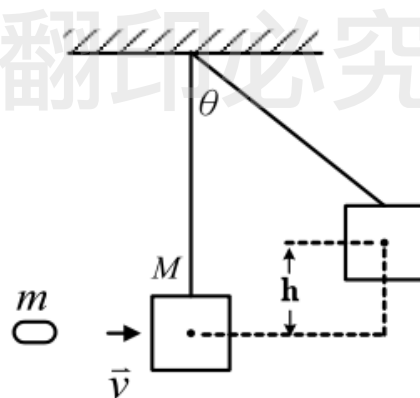
往後系統(子彈+木頭)被視為一個點，它的速度為  $V_{cm}$ ，利用功與能中之動能變成重力位能

$$\Rightarrow \frac{1}{2}(m + M)V_{cm}^2 = (m + M)gh \text{-----(2)}$$

(1) 代入(2)得

$$\Rightarrow \frac{1}{2}(m + M)\left(\frac{m}{m + M}v\right)^2 = (m + M)gh$$

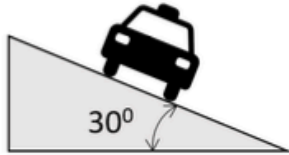
$$\Rightarrow v = \sqrt{\frac{m + M}{m}2gh}$$



## 高醫後西醫物理110年第三十五題

100% 命中

35. A toy car is running on a banked circular track of radius 10 m, as shown below. If the car weighs 5 kg and on wet ice, find the maximum velocity for the car to keep on the track without skid. (Gravitational acceleration  $g = 10 \text{ m/s}^2$ ,  $\cos 30^\circ = 0.87$ ,  $\cos 60^\circ = 0.5$ )



- (A) 5.4 m/s    (B) 7.6 m/s    (C) 9.4 m/s    (D) 12.6 m/s    (E) 15.7 m/s

## 高點程量子物理 (上課講義 ) 第三章第三十五題

3-35一汽車行駛於轉彎的公路上，若路面的傾斜角為 $\theta$ ，曲率半徑為 $R$ ，求行車速度與傾斜角的關係。

解

汽車是在作圓周運動，故座標軸

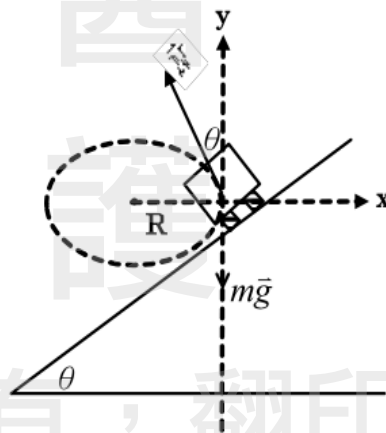
由運動定律

$$\sum F_x = -N \sin \theta = -ma_x = -m \frac{v^2}{R}$$

$$\sum F_y = N \cos \theta - mg = ma_y = 0$$

由以上兩式消去  $N$  得

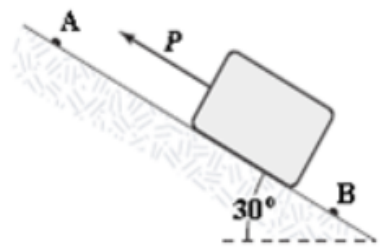
$$v = (Rg \tan \theta)^{1/2}$$



## 高醫後西醫物理110年第三十八題

100% 命中

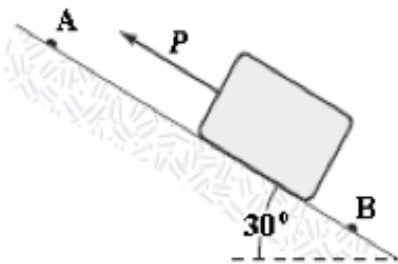
38. A 2-kg block slides down a frictionless incline from point A to point B. A force (magnitude  $P = 3\text{ N}$ ) acts on the block between A and B, as shown in the figure. Points A and B are 2 m apart. If the kinetic energy of the block at A is 10 J, what is the kinetic energy of the block at B? (Gravitational acceleration  $g = 10\text{ m/s}^2$ )



- (A) 17 J      (B) 20 J      (C) 24 J      (D) 27 J      (E) 37 J

## 高點程量子物理 (七百題題庫)

7. A 2.0-kg block slides down a frictionless incline from point A to point B. A force (magnitude  $P = 3.0\text{ N}$ ) acts on the block between A and B, as shown. Points A and B are 2.0 m apart. If the kinetic energy of the block at A is 10 J, what is the kinetic energy of the block at B?



- (A) 27 J      (B) 20 J      (C) 24 J      (D) 17 J      (E) 37 J

7. 解：(C)

由機械能守恆  $E = K + U$

$$10 + 2 \times 9.8 \times 2 \sin 30 = K + 3 \times 2 \Rightarrow K = 23.6 [J]$$

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高醫後西醫物理110年第四十五題

100% 命中

45. Water pressurized to  $3.5 \times 10^5$  Pa is flowing at 5.0 m/s in a horizontal pipe which contracts to 1/3 its former area. What are the pressure and flow speed of the water after the contraction?

- (A)  $2.5 \times 10^5$  Pa, 15 m/s      (B)  $3.0 \times 10^5$  Pa, 10 m/s      (C)  $3.0 \times 10^5$  Pa, 15 m/s  
 (D)  $4.5 \times 10^5$  Pa, 1.5 m/s      (E)  $5.5 \times 10^5$  Pa, 1.5 m/s

高點程量子物理 (上課作業)

6. Water pressurized to  $3.5 \times 10^5$  Pa is flowing at 5.0 m/s in a horizontal pipe which contracts to 1/3 its former area. What are the pressure and velocity of the water after the contraction?

- (A)  $2.5 \times 10^5$  Pa, 15 m/s      (B)  $3.0 \times 10^5$  Pa, 10 m/s      (C)  $3.0 \times 10^5$  Pa, 15 m/s  
 (D)  $4.5 \times 10^5$  Pa, 1.5 m/s      (E)  $5.5 \times 10^5$  Pa, 1.5 m/s

6. 解：(A)

$$\text{由 } A_1 v_1 = A_2 v_2$$

$$A_1(5) = \left(\frac{1}{3} A_1\right)v_2 \Rightarrow v_2 = 15[m/s]$$

$$\text{由 } P_1 + \frac{1}{2} \rho v_1^2 + \rho g y_1 = P_2 + \frac{1}{2} \rho v_2^2 + \rho g y_2$$

$$3.5 \times 10^5 + \frac{1}{2} \times 1000 \times 5^2 = P_2 + \frac{1}{2} \times 1000 \times 15^2$$

$$\Rightarrow 3.5 \times 10^5 = P_2 + 100000$$

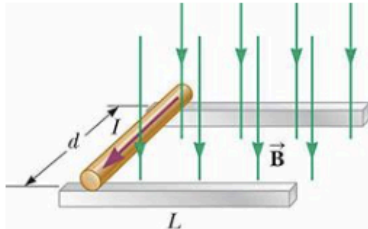
$$\Rightarrow P_2 = 2.5 \times 10^5 [Pa]$$

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100% 命中

高醫後西醫物理110年第五十一題

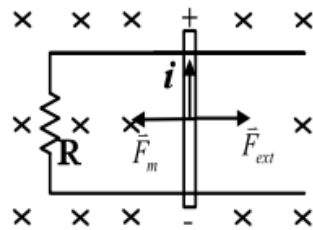
51. A rod of 0.3 m carries a current of  $I = 48.0$  A in the direction shown in the figure and rolls along the rails with a constant speed. A uniform magnetic field of magnitude 0.25 T is directed perpendicular to the rod and the rails. What is the force acting on the rod?



- (A) 3.6 N (→) (B) 2.4 N (←) (C) 1.2 N (←) (D) 3.6 N (←) (E) 1.2 N (→)

高點程量子物理 (上課講義) 磁學第三章

在外力  $\vec{F}_{ext}$  作用於磁場中的金屬棒時，棒上會產生感應電流  $i$ ，見圖。此載流金屬棒又因存在於磁場  $\vec{B}$  內，它受磁場力  $\vec{F}_m$ 。當此棒向右等速運動時， $|\vec{F}_{ext}| = |\vec{F}_m|$ ，單位時間外力  $\vec{F}_{ext}$  對金屬棒



高醫後西醫物理110年第五十五題

100% 命中

55. An AC generator consists of 6 turns of a wire. Each turn has an area of  $0.040 \text{ m}^2$ . The loop rotates in a uniform field ( $B = 0.20 \text{ T}$ ) at a constant frequency of 50 Hz. What is the maximum induced emf?

- (A) 2.4 V (B) 3.0 V (C) 4.8 V (D) 13 V (E) 15 V

高點程量子物理 (上課作業)

6. A 10 turn conducting loop with a radius of 3.0 cm spins at 60 revolutions per second in a magnetic field of 0.50 T. The maximum emf generated is:

- (A) 0.014 V (B) 0.085 V (C) 0.53 V (D) 0.85 V (E) 5.3 V

6. 解：(E)

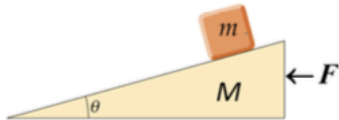
$$\begin{aligned} \varepsilon &= -N \frac{d\phi_B}{dt} \\ &= -N \frac{d}{dt} BA \cos(\omega t) = NBA\omega \sin(\omega t) = \varepsilon_{\max} \sin(\omega t) \\ \varepsilon_{\max} &= NBA\omega = 10 \times 0.5 \times \pi(3 \times 10^{-2})^2 \times 60 \times 2\pi = 5.32[V] \end{aligned}$$

100% 命中

高醫後西醫物理110年第三十六題

36. A small block of mass  $m$  rests on the sloping side of a triangular block of mass  $M$  which itself rests on a horizontal table as shown in the figure below. Assuming all surfaces are frictionless, determine the magnitude of the force  $F$  that must be applied to  $M$  so that  $m$  remains in a fixed position relative to  $M$ .

Hint: 1. Take  $x$  and  $y$  axes horizontal and vertical. 2. Focus at the object  $m$ .



- (A)  $mg \sin\theta$  (B)  $mg \tan\theta$  (C)  $(m+M)g \tan\theta$   
 (D)  $(m+M)g \sin\theta$  (E) None of these

高點程量子物理 (總複習)

3. A rectangular block of mass 1 kg rests on a  $30^\circ$ -wedge-shaped block of mass 3 kg, as shown in the figure. Neglecting all the frictions between the contact surfaces, find the magnitude of horizontal force  $F$  that must be applied to the wedge in order that the rectangular block does not slide along the wedge:

- (A) 19.60 N (B) 22.63 N  
 (C) 27.72 N (D) 33.95 N



Problem 3

3. 解：(B)

由  $\vec{F} = m\vec{a}$

$F = (m_1 + m_3)a$ ------(1)

$N - m_1 g \cos\theta - m_1 a \sin\theta = 0$ ------(2)

$m_1 g \sin\theta - m_1 a \cos\theta = 0$ ------(3)

由(3)得  $\tan\theta = \frac{a}{g} \Rightarrow a = \frac{1}{\sqrt{3}}g$

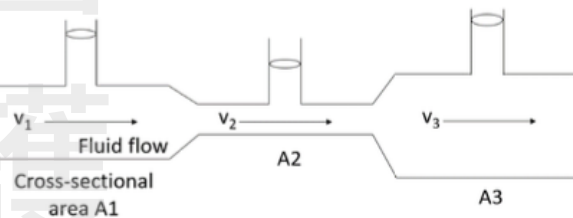
代入(1)得  $F = (1+3)\frac{1}{\sqrt{3}} \times 9.8 = 22.63[N]$

高醫後西醫物理110年第八題

90% 命中

8. A tube with three openings has three different cross-sectional areas ( $A_1:A_2:A_3 = 2:1:3$ ), as shown in the figure. The pressure difference is 25 Pa between  $A_1$  and  $A_2$ . If  $v_1 = 0.125$  (m/s), find the density of the fluid ( $\text{kg/m}^3$ ).

- (A) 561 (B) 982 (C) 1067 (D) 1534 (E) 1698



高點程量子物理 (七百題題庫)

10. Water pressurized to  $3.5 \times 10^5$  Pa is flowing at 5.0 m/s in a horizontal pipe which contracts to 1/3 its former area. What are the pressure and velocity of the water after the contraction?

- (A)  $2.5 \times 10^5$  Pa, 15 m/s (B)  $3.0 \times 10^5$  Pa, 10 m/s (C)  $3.0 \times 10^5$  Pa, 15 m/s  
 (D)  $4.5 \times 10^5$  Pa, 1.5 m/s (E)  $5.5 \times 10^5$  Pa, 1.5 m/s

10. 解：(A)

由  $A_1 v_1 = A_2 v_2$

$A_1(5) = (\frac{1}{3}A_1)v_2 \Rightarrow v_2 = 15[m/s]$

由  $P_1 + \frac{1}{2}\rho v_1^2 + \rho g y_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2$

$3.5 \times 10^5 + \frac{1}{2} \times 1000 \times 5^2 = P_2 + \frac{1}{2} \times 1000 \times 15^2$

$\Rightarrow 3.5 \times 10^5 = P_2 + 100000$

$\Rightarrow P_2 = 2.5 \times 10^5[Pa]$



高醫後西醫物理110年第十題

90% 命中

10. Two waves traveling in opposite directions interfere to produce a standing wave described by  $y = 3 \sin(2x) \cos(5t)$  where  $x$  is in m and  $t$  is in s. What is the wavelength of the interfering waves?

- (A) 3.14 m      (B) 1.00 m      (C) 2.00 m      (D) 6.28 m      (E) 12.00 m

高點程量子物理 (總複習) 複習題庫

41. The transverse displacement of a standing wave on a string is given by

$$y(x,t) = 4 \sin(0.5x) \cos(30t),$$

where  $x$  and  $y$  are in centimeters (cm). What is the wave speed of component waves?

- (A) 10 cm/s      (B) 15 cm/s      (C) 30 cm/s      (D) 60 cm/s      (E) 120 cm/s.

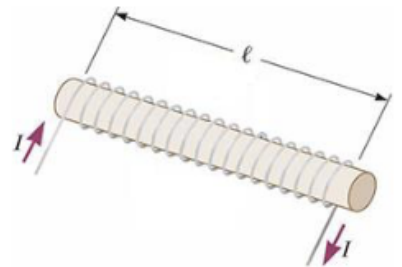
41. 解：(D)

$$v = \frac{\omega}{k} = \frac{30}{0.5} = 60 [cm/s]$$

高醫後西醫物理110年第五十八題

90% 命中

58. A solenoid with 200 turns of copper wires is operated by a 1000 V power supply and must be 25 cm long. What is the magnitude of magnetic field that is created in the solenoid? (The resistance of Cu wire is  $0.2 \Omega$  and the permeability  $\mu_0 = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$ )



- (A) 5.03 T      (B) 3.21 T      (C) 7.84 T      (D) 4.58 T      (E) 4.36 T

高點程量子物理 (上課作業 )

7. A 0.50-m long solenoid consists of 1 000 turns of copper wire wound with a 4.0 cm radius. When the current in the solenoid is 18 A, the magnetic field at a point 1.0 cm from the central axis of the solenoid is

- (A) 0.090 mT      (B) 0.36 mT      (C) 23 mT      (D) 36 mT      (E) 45 mT

7. 解：(E)

$$B = n\mu_0 i = \frac{N}{l} \mu_0 i = \frac{1000}{0.5} (4\pi \times 10^{-7})(18) = 0.0452 = 45.2 [mT]$$

高醫後西醫物理110年第五十三題

90% 命中

53. Two parallel thin planes of charge electrical charge density  $2.5 \times 10^8 \text{ C/m}^2$ . What is the electric field in the region between the two planes? Assume that the vacuum electric permittivity is  $\epsilon_0 = 8.9 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2$ .
- (A)  $2.8 \times 10^{18} \text{ N/C}$                       (B)  $5.6 \times 10^{19} \text{ N/C}$                       (C)  $1.4 \times 10^{18} \text{ N/C}$   
(D)  $2.8 \times 10^{19} \text{ N/C}$                       (E)  $4.2 \times 10^{19} \text{ N/C}$

高點程量子物理 (上課作業)

3. Two infinite parallel surfaces carry uniform charge densities of  $0.20 \text{ nC/m}^2$  and  $-0.60 \text{ nC/m}^2$ . What is the magnitude of the electric field at a point between the two surfaces?
- (A) 34 N/C      (B) 23 N/C      (C) 45 N/C      (D) 17 N/C      (E) 90 N/C

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## 試題詳解

1.  $1.25 \times 0.25 + 1.222 = \underline{\hspace{2cm}}$ .  
 (A) 1.5345      (B) 1.535      (C) 1.53      (D) 1.5      (E) 2

1. 解：(C)

$$1.25 \times 0.25 = 0.3125$$

$$0.3125 + 1.222 = 1.5345$$

根據有效位數規則，小數點(對齊)，取(小數位最短)，故1.53

2. Over a short interval near time  $t = 0$  the coordinate of a bicycle in meters is given by  $x(t) = 12t - 4t^3$ , where  $t$  is in seconds. At the end of 1 s, what is the acceleration of the bicycle?

- (A)  $23 \text{ m/s}^2$       (B)  $15 \text{ m/s}^2$       (C)  $-4 \text{ m/s}^2$       (D)  $-12 \text{ m/s}^2$       (E)  $-24 \text{ m/s}^2$

2. 解：(E)

$$x(t) = 12t - 4t^3$$

$$\Rightarrow v(t) = 12 - 12t^2$$

$$\Rightarrow a(t) = -24t$$

$$a(1) = -24$$

3. A 8000-N trunk is pushed along a level road by two men who apply a total forward force of 1000 N. Neglecting friction, what is the acceleration of the trunk?

(Gravitational acceleration  $g = 10 \text{ m/s}^2$ )

- (A)  $0.0125 \text{ m/s}^2$       (B)  $0.125 \text{ m/s}^2$       (C)  $0.8 \text{ m/s}^2$       (D)  $1.25 \text{ m/s}^2$       (E)  $8 \text{ m/s}^2$

3. 解：(D)

$$W = mg \Rightarrow 8000 = m \cdot 10 \Rightarrow m = 800 [kg]$$

$$F = ma \Rightarrow 1000 = 800 \cdot a \Rightarrow a = 1.25 [m/s^2]$$

4. An incompressible fluid of density  $\rho$  is in a bucket on the elevator floor accelerating upward with acceleration  $a$ . What is the pressure difference between two points in the fluid separated by a vertical distance  $\Delta h$ ? (Gravitational acceleration is  $g$ )

- (A)  $\rho a \Delta h$       (B)  $\rho g \Delta h$       (C)  $\rho g a \Delta h$       (D)  $\rho(g - a) \Delta h$       (E)  $\rho(g + a) \Delta h$

4. 解：(E)

$$P_2 = P_0 + \rho g y_2$$

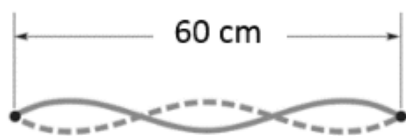
$$P_1 = P_0 + \rho g y_1$$

$$\Rightarrow \Delta P = P_2 - P_1 = \rho g (y_2 - y_1) = \rho g \Delta h$$

題意說電梯向上加速，故有一假想力向下，與重力方向相同

$$\Rightarrow \Delta P = \rho(g + a) \Delta h$$

5. The figure shows a standing wave pattern in a string. What is the wavelength of one of the component traveling waves?

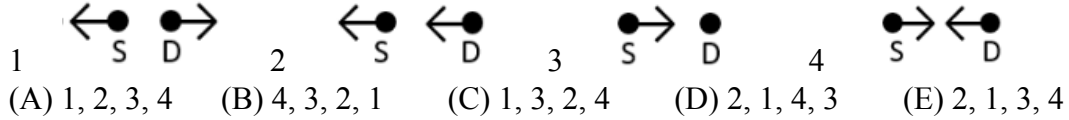


- (A) 10 cm      (B) 20 cm      (C) 40 cm      (D) 60 cm      (E) 120 cm

5. 解：(C)

$$60 \div 3 \times 2 = 40 [cm]$$

6. The figure shows four situations in which a source of sound S and a detector D are either moving or stationary. The arrows indicate the directions of motion. The speeds (when not zero) are all the same. (Note that the detector in situation 3 is stationary). Rank the situations according to the apparent frequency of the source, lowest to highest.



6. 解：(A)

$$1: v_R = \frac{u - u_R}{u + u_S} v_S \qquad 3: v_R = \frac{u}{u - u_S} v_S$$

$$2: v_R = \frac{u + u_R}{u + u_S} v_S \qquad 4: v_R = \frac{u + u_R}{u - u_S} v_S$$

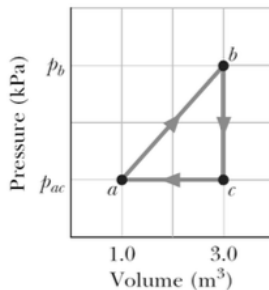
7. What is the deterministic factor of a sound wave for the sound pitch?

- (A) amplitude    (B) frequency    (C) phase    (D) speed    (E) intensity

7. 解：(B)

音高(sound pitch)為在音樂方面使用的名稱，其單位為[Hz]，由頻率決定頻譜

8. A sample of an ideal gas is taken through the cyclic process *abca* shown in the figure. The scale of the vertical axis is set by  $p_b = 15\text{kPa}$  and  $p_{ac} = 5\text{kPa}$ . At point *a*,  $T = 200\text{K}$ . What is the temperature of the gas at point *c*?



- (A) 400 K    (B) 600 K    (C) 1419 K    (D) 1800 K    (E) 4258 K

8. 解：(B)

At point *a*

$$P_a V_a = nRT_a \Rightarrow 5 \times 1 = nR \times 200 \Rightarrow nR = 0.025$$

At point *c*

$$P_c V_c = nRT_c \Rightarrow 5 \times 3 = 0.025 \times T_c \Rightarrow T_c = 600[K]$$

9. An engine does 15 kJ of work while exhausting 37 kJ to a cold reservoir. What is the efficiency of the engine?

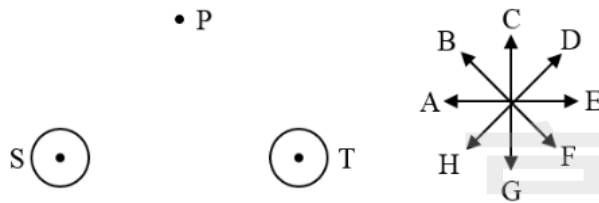
- (A) 28.8 %    (B) 38.8 %    (C) 68.8 %    (D) 88.8 %    (E) 98.8 %

9. 解：(A)

$$W = Q_h - Q_c \Rightarrow 15 = Q_h - 37 \Rightarrow Q_h = 52[kJ]$$

$$e = \frac{W}{Q_h} = \frac{15}{52} = 0.288 \approx 28.8\%$$

10. The point P lies along the perpendicular bisector of the line connecting two long straight wires S and T that are perpendicular to the page. A set of directions A through H is shown next to the figure. When the two equal currents in the wires are directed up out of the page, the direction of the magnetic field at P is closest to the direction of \_\_\_\_\_.



- (A) A                      (B) E                      (C) F                      (D) G                      (E) H

10. 解：(A)

由安培定律及向量重疊原理可得

11. Consider radio waves (r), visible light (v), infrared (i), X-rays (x), and ultraviolet (u). In order of increasing frequency, they are \_\_\_\_\_.

- (A) r, v, i, x, u    (B) r, i, v, u, x    (C) i, r, v, u, x    (D) x, u, v, i, r    (E) r, i, v, x, u

11. 解：(B)

電磁波譜頻率由低到高：無線電波, 紅外線, 可見光, 紫外線, X光,

12. An erect object is in front of a convex mirror a distance greater than the focal length. The image is \_\_\_\_\_.

- (A) real, inverted, and smaller than the object  
 (B) virtual, inverted, and larger than the object  
 (C) real, inverted, and larger than the object  
 (D) virtual, erect, and smaller than the object  
 (E) real, erect, and larger than the object

12. 解：(D)

凸面鏡不管物體在鏡前何處，影像均呈正立縮小虛像

13. The major physics principle that supports endoscope is \_\_\_\_\_.

- (A) refraction of light    (B) diffraction of light    (C) interference of light  
 (D) scattering of light    (E) total internal reflection of light

13. 解：(E)

內視鏡的原理為全反射

14. If we increase the wavelength of the light that falls on the metal in a photoelectric-effect experiment, which of the following will happen?

- (A) The work function of the metal increases.  
 (B) The cutoff frequency decreases.  
 (C) The stopping potential decreases.  
 (D) The time delay of the emission of photoelectron increases.  
 (E) All of the above.

14. 解：(C)

$$eV = \frac{1}{2}mv^2 = hv - e\phi = \frac{hc}{\lambda} - e\phi$$

波長變長，則光子能量降低，stopping potential  $V$  下降

15. For the particles listed below with the same kinetic energy, which has the shortest wavelength?

(A) electron    (B) positron    (C) proton    (D)  $\alpha$  particle    (E) neutron

15. 解：(D)

$$\lambda_d = \frac{h}{P} = \frac{h}{\sqrt{2mK}}$$

動能相同，質量越大，則波長越短

(其他試題詳解，歡迎參考高點出版67MU201706【物理歷屆試題解析（111~88年）】一書)

高  
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